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Bistable transport properties of a quasi-one-dimensional Wigner solid on liquid helium under continuous driving

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Abstract

© 2017 American Physical Society. We investigate low-frequency fluctuations in the transport characteristics of a quasi-1D Wigner solid (WS) moving along a liquid helium substrate in response to a sinusoidal driving voltage. The fluctuations occur between distinct transport modes in which the decoupling of the WS from ripplonic polarons (or "dimple lattice," DL) formed on the helium surface does, or does not, occur during each ac cycle. We demonstrate that a Gaussian-like distribution in the decoupling threshold force gives rise to this bistability, as the low-frequency switching occurs when the probability of decoupling during each ac cycle is small but finite. We attribute the distribution in the decoupling threshold force to the range of structural configurations allowed for the quasi-1D electron lattice, which influences the strength of the WS-DL coupling. Hence, the switching rate between the ac transport modes is extremely sensitive to the microscopic properties of the electron solid.

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